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Characterization of European CO₂ Storage — European Project SiteChar Caractérisation de sites européens de stockage de CO₂ — Projet européen SiteChar

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- 523 > *Editorial – Characterization of European CO₂ Storage – European Project SiteChar*
Éditorial – Caractérisation de sites européens de stockage de CO₂ – Projet européen SiteChar
F. Kalaydjian
- 531 > *SiteChar – Methodology for a Fit-for-Purpose Assessment of CO₂ Storage Sites in Europe*
SiteChar – Une méthodologie pour une caractérisation appropriée des sites de stockage de CO₂
F. Delprat-Jannaud, J. Pearce, M. Akhurst, C.M. Nielsen, F. Neele, A. Lothe, V. Volpi, S. Brunsting and O. Vincké
- 555 > *CO₂ Storage Feasibility: A Workflow for Site Characterisation*
Faisabilité du stockage géologique du CO₂ : une méthodologie pour la caractérisation des sites de stockage
M. Nepveu, F. Neele, F. Delprat-Jannaud, M. Akhurst, O. Vincké, V. Volpi, A. Lothe, S. Brunsting, J. Pearce, A. Battani, A. Baroni, B. Garcia, C. Hofstee and J. Wollenweber
- 567 > *Risk Assessment-Led Characterisation of the SiteChar UK North Sea Site for the Geological Storage of CO₂*
Caractérisation d'un site de stockage géologique de CO₂ situé en Mer du Nord (Royaume-Uni) sur la base d'une analyse de risques
M. Akhurst, S.D. Hannis, M.F. Quinn, J.-Q. Shi, M. Koenen, F. Delprat-Jannaud, J.-C. Lecomte, D. Bossie-Codreanu, S. Nagy, Ł. Klimkowski, D. Gei, M. Plummaekers and D. Long
- 587 > *How to Characterize a Potential Site for CO₂ Storage with Sparse Data Coverage – a Danish Onshore Site Case*
Comment caractériser un site potentiel pour le stockage de CO₂ avec une couverture de données éparpillées – le cas d'un site côtier danois
C.M. Nielsen, P. Frykman and F. Dalhoff
- 599 > *Coupled Hydro-Mechanical Simulations of CO₂ Storage Supported by Pressure Management Demonstrate Synergy Benefits from Simultaneous Formation Fluid Extraction*
Des simulations du comportement hydromécanique d'un réservoir géologique de stockage de CO₂ dans un contexte de gestion de la pression démontrent les avantages de l'extraction de fluide de la formation au cours de l'injection du CO₂
T. Kempka, C.M. Nielsen, P. Frykman, J.-Q. Shi, G. Bacci and F. Dalhoff
- 615 > *The Importance of Baseline Surveys of Near-Surface Gas Geochemistry for CCS Monitoring, as Shown from Onshore Case Studies in Northern and Southern Europe*
Importance des lignes de base pour le suivi géochimique des gaz près de la surface pour le stockage géologique du CO₂, illustration sur des pilotes situés à terre en Europe du Nord et du Sud
S.E. Beaubien, L. Ruggiero, A. Annunziatellis, S. Bigi, G. Ciotoli, P. Deiana, S. Graziani, S. Lombardi and M.C. Tartarello
- 635 > *Structural and Parametric Models of the Zalecze and Żuchłów Gas Field Region, Fore-Sudetic Monocline, Poland – An Example of a General Static Modeling Workflow in Mature Petroleum Areas for CCS, EGR or EOR Purposes*
Modèles structurels et paramétriques de la région des gisements de gaz de Zalecze et Żuchłów, Région monoclinale des Sudètes, Pologne – un exemple du déroulement d'une modélisation statique générale dans des zones de pétrole matures dans un but de CCS, EGR ou d'EOR
B. Papiernik, B. Doligez and Ł. Klimkowski
- 655 > *Numerical Simulations of Enhanced Gas Recovery at the Zalecze Gas Field in Poland Confirm High CO₂ Storage Capacity and Mechanical Integrity*
Des simulations numériques de récupération assistée de gaz sur un gisement de gaz de Zalecze en Pologne confirment les capacités de stockage de CO₂ élevées et l'intégrité mécanique dudit gisement
Ł. Klimkowski, S. Nagy, B. Papiernik, B. Orlic and T. Kempka
- 681 > *Pore to Core Scale Simulation of the Mass Transfer with Mineral Reaction in Porous Media*
Modélisation des phénomènes de transferts de masse dans les milieux poreux soumis à une réaction de surface : de l'échelle du pore à l'échelle de la carotte
S. Bekri, S. Renard and F. Delprat-Jannaud
- 695 > *Evaluation and Characterization of a Potential CO₂ Storage Site in the South Adriatic Offshore*
Évaluation et caractérisation d'un site de stockage potentiel de CO₂ au sud de la Mer Adriatique
V. Volpi, E. Forlin, A. Baroni, A. Estublier, F. Donda, D. Civile, M. Caffau, S. Kuczyński, O. Vincké and F. Delprat-Jannaud
- 713 > *Southern Adriatic Sea as a Potential Area for CO₂ Geological Storage*
Le sud de l'Adriatique, un secteur potentiel pour le stockage du CO₂
V. Volpi, F. Forlin, F. Donda, D. Civile, L. Facchin, S. Sauli, B. Merson, K. Sinza-Mendieta and A. Shams
- 729 > *Dynamic Fluid Flow and Geomechanical Coupling to Assess the CO₂ Storage Integrity in Faulted Structures*
Couplage des modélisations hydrodynamique et géomécanique pour évaluer l'intégrité d'un stockage de CO₂ dans des structures faillées
A. Baroni, A. Estublier, O. Vincké, F. Delprat-Jannaud and J.-F. Nauroy
- 753 > *Techno-Economic Assessment of Four CO₂ Storage Sites*
Évaluation technico-économique de quatre sites de stockage de CO₂
J.-F. Gruson, S. Serbutoviez, F. Delprat-Jannaud, M. Akhurst, C. Nielsen, F. Dalhoff, P. Bergmo, C. Bos, V. Volpi and S. Iacobellis
- 767 > *CCS Acceptability: Social Site Characterization and Advancing Awareness at Prospective Storage Sites in Poland and Scotland*
Acceptabilité du CCS : caractérisation sociale du site et sensibilisation du public autour de sites de stockage potentiels en Pologne et en Écosse
S. Brunsting, J. Mastop, M. Kaiser, R. Zimmer, S. Shackley, L. Mabon and R. Howell

CCS Acceptability: Social Site Characterization and Advancing Awareness at Prospective Storage Sites in Poland and Scotland

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Abstract — This paper summarizes the work on the social dimension conducted within the EU FP7 SiteChar project. The most important aim of the research was to advance public awareness and draw lessons for successful public engagement activities when developing a CO₂ storage permit application. To this end, social site characterization (e.g. representative surveys) and public participation activities (focus conference) were conducted at two prospective Carbon Capture and Storage (CCS) sites: an onshore site in Poland and an offshore site in Scotland. The research consisted of four steps over a time period of 1.5 year, from early 2011 to mid-2012. The first step consisted of four related qualitative and quantitative research activities to provide a social characterization of the areas: desk research, stakeholder interviews, media analyses, and a survey among representative samples of the local community. The aim was to identify:

- stakeholders or interested parties;
- factors that may drive their perceptions of and attitudes towards CCS.

Results were used to as input for the second step, in which a new format for public engagement named 'focus conferences' was tested at both sites involving a small sample of the local community. The third step consisted of making available generic as well as site-specific information to the general and local public, by:

- setting up a bilingual set of information pages on the project website suitable for a lay audience;
- organizing information meetings at both sites that were open to all who took interest.

The fourth step consisted of a second survey among a new representative sample of the local community. The survey was largely identical to the survey in step 1 to enable the monitoring of changes in awareness, knowledge and opinions over time.

Results provide insight in the way local CCS plans may be perceived by the local stakeholders, how this can be reliably assessed at early stage without raising unnecessary concerns, and how results of this inventory can be used to develop effective local communication and participation strategies. In future project development, if any, these results can be used to start up and inform the process of information provision and public engagement.

Résumé — Acceptabilité du CCS : caractérisation sociétale du site et sensibilisation du public autour de sites de stockage potentiels en Pologne et en Écosse

Cet article résume les travaux menés autour de la dimension sociale dans le cadre du projet SiteChar FP7 de l'Union Européenne. L'enjeu principal de ce travail de recherche était d'avancer en matière de sensibilisation du public et d'en tirer des leçons en vue de mener des activités d'engagement du public dans le cadre du développement d'applications de permis de stockage de CO₂. Dans ce but, une caractérisation sociétale (sur la base entre autres de sondages représentatifs) et la participation du public (conférences en petits groupes) ont été réalisées sur deux sites potentiels de Capture et de Stockage du CO₂ (CCS) : un site onshore en Pologne et un site offshore en Écosse. La recherche consistait en quatre étapes conduites sur une période d'un an et demi, depuis le début de l'année 2011 jusqu'au milieu de 2012. La première étape comprenait quatre activités de recherche qualitative et quantitative, dédiée à la caractérisation sociale des localités concernées par les projets potentiels ; recherches documentaires, interview des parties prenantes, analyse des informations communiquées par les différents médias, ainsi qu'un sondage mené auprès d'un échantillon représentatif de la communauté locale. Il s'agissait d'identifier :

- les parties prenantes ou intéressées ;
- les facteurs susceptibles d'influer sur leurs perceptions et leurs attitudes envers le CCS.

Les résultats ont été utilisés pour la seconde étape, dans laquelle un nouveau format pour les activités d'engagement sociétal, sous la forme de conférences en petits groupes, a été testé sur les deux sites auprès d'un petit échantillon de la communauté locale. La troisième étape consistait à mettre à disposition du public en général et des communautés locales en particulier, des informations génériques ainsi que des informations spécifiques au site :

- un ensemble de pages d'informations bilingues accessibles depuis le site web du projet et adaptées au grand public ;
- organisation de réunions d'informations pour les deux sites, ouvertes à tous les citoyens potentiellement intéressés par le sujet.

La quatrième étape consistait en un second sondage auprès d'un nouvel échantillon représentatif de la communauté locale, enquête largement identique à celle de la première étape de façon à évaluer les évolutions de la sensibilité du public, de son niveau de connaissances et de son opinion au fil du temps.

Les résultats obtenus dans le cadre de ce projet fournissent un aperçu sur la manière dont les projets de CCS peuvent être perçus par les parties prenantes locales, sur les moyens d'évaluer la sensibilité du public avec fiabilité dans une phase précoce du développement du projet et sans provoquer d'inutiles inquiétudes et sur la façon d'utiliser des résultats de ces inventaires pour développer des stratégies de communication et de participation locales efficaces. Ces résultats devraient être utiles lors du développement de nouveaux projets pour lancer et faire évoluer les processus de communication et de participation des populations.

INTRODUCTION

At the local level, public support has proven crucial to the implementation of Carbon Capture and Storage (CCS) demonstration projects, as demonstrated by the public's reaction to CCS projects in, amongst other countries, the Netherlands [1], Germany [2], and Poland [3]. Although there are also examples in which local demonstrations received public support or have at least not been rejected, such as the Lacq project in France [4], the experiences to date emphasize that if local CCS projects are to take off, the public should

be consulted and involved in decision-making about prospective CCS projects. Whereas no method exists to guarantee public acceptability of any project, a constructive stakeholder and citizen's participation process does increase the likelihood thereof. This implies a shift in focus from project to process in decision making (*Fig. 1*).

Social site characterisation is the process of investigating and monitoring the local social circumstances in a specified spatial area, changes therein over time, and underlying factors shaping public awareness and public opinion [6, 7]. It can be used as an instrument to design,

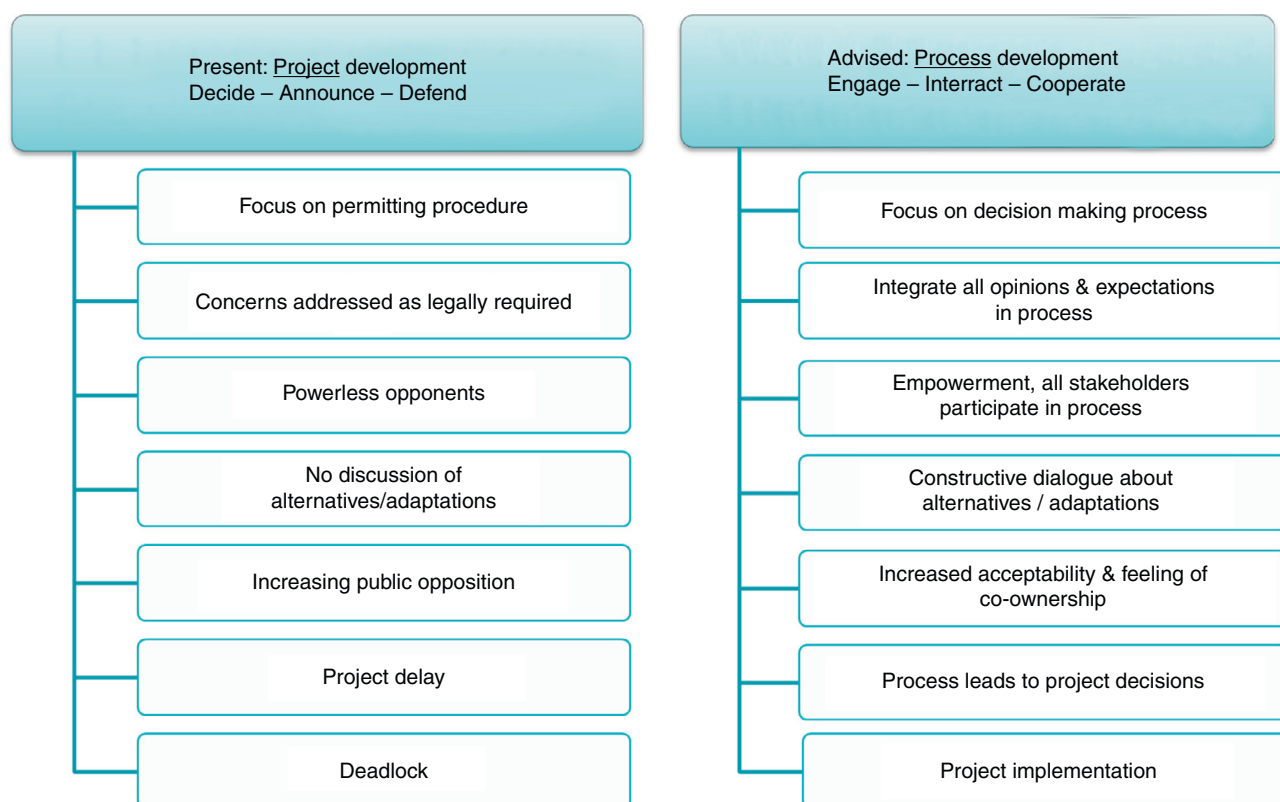


Figure 1
Differences between a focus on project *versus* process in decision making⁽¹⁾.

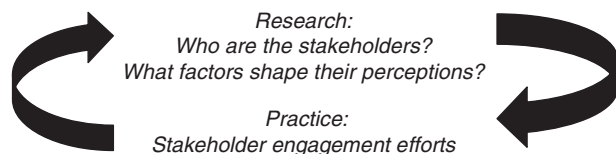


Figure 2
Social site characterisation

plan and evaluate the process of active and constructive local stakeholder and citizen engagement with the aim of building trust, raising public awareness, and informing the public (Fig. 2).

¹ Inspired by NEA report *Stepwise Approach to Decision Making for Long-term Radioactive Waste Management, Experience, Issues and Guiding Principles* [5], in which it is stated that “The new dynamic of dialogue and decision-making process has been characterized as a shift from a more traditional “decide, announce and defend” model, focused on technical assurance, to one of “engage, interact and co-operate”, for which both technical assurance and quality of the process are of comparable importance to a constructive outcome”.

Similar to other aspects of site characterization [8], social site characterization is site- (area) specific. Although there are general ‘best practice’ approaches which clearly describe the steps to follow, see for example [9-13] as well as comparative reviews of approaches in [3, 14], the implementation of each step should be tailored to the area in question and to the needs of the participants in the process. Ideally, therefore, social site characterisation and public engagement activities should be an integral part of the site characterisation workflow and should be included in the EU Storage Directive. In line with this view, the general aim of the SiteChar project⁽²⁾ is to develop an effective methodology for the preparation of storage permit applications, incorporating all the technical and economic data, as well as the social dimension.

This paper summarises the work on the social dimension of two prospective CCS sites within the SiteChar project. The most important aim of the research was to

² <http://www.sitechar-co2.eu/>

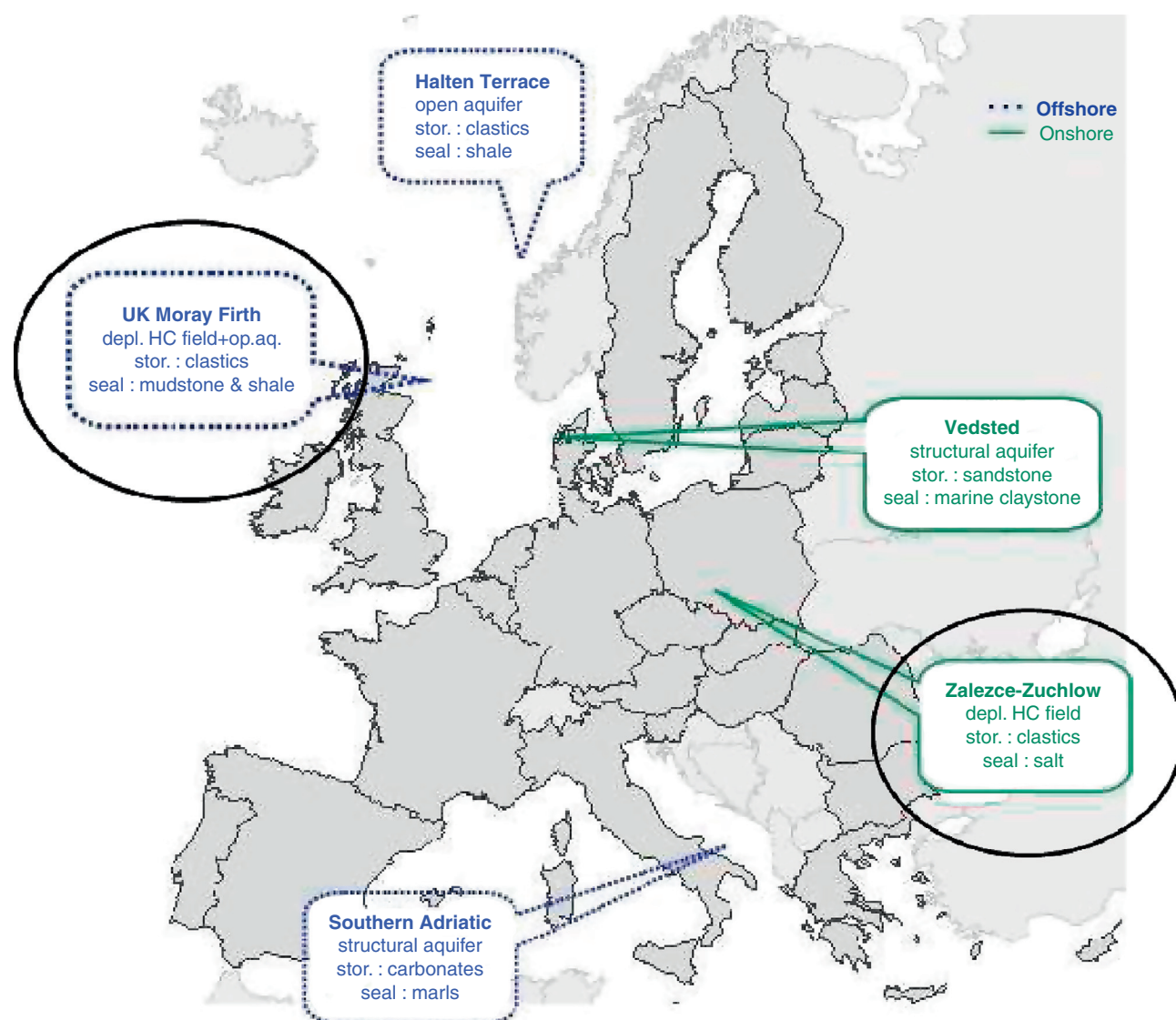


Figure 3

Sites under study in the SiteChar project with sites investigated for public engagement activities circled in black.

understand, interpret, advance public awareness and draw lessons for the development of industrial projects. To this end, social site characterisation and public participation activities were conducted at two prospective CCS sites: an onshore site and an offshore site (Fig. 3). The onshore site is the Załęcz & Żuchłów site in Poland, for which the research focused on the district Góra and municipalities Rawicz and Bojanowo in district Rawicz, and the offshore site is the North Sea Moray Firth site in Scotland, for which the research focused on the communities in Morayshire.

The research consisted of four steps (Tab. 1) over a time period of 1.5 year, from early 2011 to mid-2012 [15-18]. The first step (described in Sect. 1) consisted of four related qualitative and quantitative research activities aiming to provide a social characterization of the areas: desk-based research, stakeholder interviews, media analyses, and a survey among representative samples of the local community. The aim was to identify:

- stakeholders or interested parties;
- factors that may drive their perceptions of and attitudes towards CCS.

TABLE 1
Overview of the timing of all activities at both sites of WP8 within SiteChar

Activities	Poland	Scotland
Step 1. Social site characterisation: – desk research – stakeholder interviews – media analysis – survey	Fieldwork first half of 2011; data processing and reporting second half of 2012	Fieldwork first half of 2011; data processing and reporting second half of 2012
Step 2. Focus conferences	30-31 March & 20-21-22 April 2012	30-31 March & 20-21-22 April 2012
Step 3. Information meeting	25 June 2012	6 September 2012
Website information	Continuously	Continuously
Step 4. Second survey	July 2012	September 2012

Results were used as an input for the second step (Sect. 2), in which a new format for public engagement (building upon existing engagement processes) named ‘focus conferences’ was tested at both sites involving a small sample of the local community. The third step (Sect. 3) consisted of making available generic as well as site-specific information to the general and local public, by:

- setting up a bilingual (English and Polish) set of information pages on the project website suitable for a lay audience;
- organizing information meetings at both sites that were open to all who took an interest and wished to participate.

The fourth step (Sect. 4) consisted of a second survey among a new representative sample of the local community. The survey was largely identical to the survey in step 1 to enable the monitoring of changes in awareness, knowledge and opinions over time.

1 STEPS 1: SOCIAL SITE CHARACTERIZATION OF THE LOCAL AREA

1.1 Method

Key to social site characterisation relies on collecting information to answer two main questions:

- who are the stakeholders or potentially interested parties?
- what factors drive stakeholders perceptions of and attitudes towards CCS?

To collect reliable information, a set of complementary qualitative and quantitative methods was used:

- desk-based research into key historical, social, geographical, economic, industrial, and political characteristics of the site and its surrounding geographical area;

- interviews with local stakeholders to inform them about, and potentially involve them in, the SiteChar project as well as to record their questions, needs, concerns, and recommendations for local public participation (open, semi-structured interviews using a topic list);
- media analysis of national (in Poland) and local (in Scotland) newspapers to investigate the frequency and tone of media coverage of CCS;
- telephone surveys using representative samples to characterize the local population in terms of awareness and opinions of CCS as well as present perceptions of the area, local needs, and most relevant and trustworthy stakeholders.

The surveys were conducted by market research firms among a representative sample of the local population in both Poland and Scotland (N = 1 000 in Poland, N = 850 in Scotland), in the period May-June 2011. In addition, a small weigh factor was applied to the responses to ensure complete representativeness of the answers to the larger population in terms of gender, age, and education. The survey took the form of a telephone interview concerning opinion of and satisfaction with the local area. The interviewer introduced the research as a 15-minute interview about ‘life in your local area’ whereby local area was described as ‘the area within about 32 km or 20 minutes driving from your home’. Apart from local plans for CCS, data from the desk research, interviews and media analyses were used to identify issues that were, or might become, a source of local tension or controversy, might impact people’s satisfaction with their living environment, and might transfer to feelings about other issues such as CCS. At both sites one ‘high-profile’ development was identified which had already given rise to local discussion and media attention, and one ‘low-profile’ development was identified which

was still in an early stage and had not (yet) been a topic of much debate.

The survey addressed the following topics:

- satisfaction with local area;
- attachment to local area;
- issues facing the area;
- issue I (CCS);
- issue II (high profile);
- issue III (low profile);
- perceived involvement in decision making;
- extent of local activism;
- trusted representatives and organisations;
- preferred information sources;
- personal information (e.g. occupation).

The issue of CCS was always mentioned first so that evaluations of other issues could not influence perceptions of CCS. The high-profile issue was mentioned second and the low-profile issue was mentioned last. The reason for placing the high-profile issue second was that questions about this issue are relatively easy for respondents to answer, thereby balancing difficult and easy questions across the survey which improves the validity of responses [19]. The interviewer asked similar questions for each issue, but here only results regarding CCS are reported.

1.2 Results and Implications

Below are summaries of relevant results and implications from the desk-based research, media analysis, the local community survey and the stakeholder interviews:

- *Relevant local developments.* At both sites unemployment was seen as one of the main local concerns. Climate change was not a salient issue. Occupants of the Scottish area consider its coastline as an asset for tourism, with dolphin spotting as one of the key activities advertised. In Poland, the area has a nature reserve that draws some visitors, however it is not actively promoted for recreational purposes, which is mainly due to the lack of facilities such as hotels. Even finding a suitable venue for the focus conferences (Sect. 2) proved difficult. Nevertheless, the desire to develop tourism in the area might become a negative argument when anticipated impacts of a local CCS project are perceived to interfere with this goal. It is recommended to anticipate this issue in future project planning and communication. Purity of drinking water is important to both areas. Furthermore, at the Polish site a drinking water reservoir is located on top of one of the two gas fields that is being evaluated for possible CO₂ storage so that this issue is likely to be a discussion topic in future contact with local public;

- *Trusted information sources.* At both sites, almost half of the survey respondents reported the internet as the most preferred medium for obtaining information. Other trusted sources were local councilors, community and local authorities, or local political parties. Family, friends and other personal contacts were mentioned by relatively few respondents. In Poland, the local radio was found to be a popular information medium too. Such site-specific findings may help communicators to plan targeted communication activities and media selection;
- *Level of awareness and knowledge of CO₂ and CCS.* At both sites, awareness and knowledge of CCS in general as well as of possible local CCS plans were low among the survey respondents, particularly in Poland (Tab. 2). Low knowledge levels imply that, apart from site-specific information on CCS, general information on CCS and its wider context (CO₂, climate change) is thus needed to help the local public understand the role of CCS as an emissions reduction technology.
- *Expectations of local CCS plans.* At both sites, expectations of local CCS plans for the region were first mainly positive (Tab. 2). Particularly at the Scottish site, the majority of survey respondents expected that CCS would bring jobs to the region and improve the local economy. In future public outreach, management of these expectations might be necessary. The main perceived negative impacts were effects of leakage of CO₂ on marine life and visual impacts of CCS installations. At the Polish site, respondents did not appear to have a clear image of what CCS might and might not bring to the region. Regarding expectations of the effects of CCS, its main perceived advantage was that it would be beneficial for the environment. However, the main perceived disadvantage was also that it would be bad for the environment. This indicates that people actually do not know well what to expect of CCS. This conclusion is strengthened by the finding that 18% of those who expected positive impacts mentioned that CCS will ‘reduce toxic waste’;
- *Media attention for CCS and its characteristics (including arguments used).* The media coverage and debate were more extensive in Scotland than in Poland, but in both countries media attention was mainly positive. In Poland, the main arguments used in favor of CCS were that it is climate friendly and that it enables to continue the use of coal. A perceived downside was that it would be costly. In addition opponents of CCS contested its security. In Scotland, the main arguments used in favor of CCS were related to enterprise and business opportunities in the offshore sector and not so much to

TABLE 2
Knowledge of local CCS, knowledge of CCS in general, and expected impact of local CCS plans (%)

	Poland		Scotland	
	1 st survey	2 nd survey	1 st survey	2 nd survey
Before this interview, how much, if anything did you know about CCS in your local area?				
	N = 1 000	N = 1 006	N = 850	N = 864
Never heard about it	85	78	54	53
Heard of but know nothing about it	8	13	31	30
A fair amount	5	6	14	15
A great deal	1	2	2	3
Before this interview, how much, if anything did you know about CCS in general?				
	N = 1 000	N = 1 006	N = 850	N = 864
Never heard about it	72	62	43	49
Heard of but know nothing about it	12	20	39	34
A fair amount	13	14	17	15
A great deal	2	3	1	2
Do you think plans for CCS will have a positive or negative impact on your local area?				
	N = 145	N = 208	N = 389	N = 407
Very positive	31	25	29	28
Slightly positive	30	30	32	27
Slightly negative	14	11	8	7
Very negative	6	7	5	6
No impact at all	12	11	10	14

Note: percentages do not always add up to 100% as some participants answered “don’t know” to the questions. Values in this table are weighed for all results, except in the second survey in Poland. Weights had a very small effect on results, as the samples were already representative of the local population.

climate change. CCS was depicted as creating a new industrial sector with significant opportunities for new job creation.

1.3 Conclusive Remarks

Among the Polish stakeholders interviewed, CCS technology and plans for carbon storage were largely unknown. Only one interview partner, an employee of a gas company, had heard of plans for the implementation of CCS in the region. Most stakeholders responded neutrally to the idea that CCS could possibly be applied in the area in the future. As most of the interviewees were not acquainted with the technology they were unable to articulate advantages or disadvantages and did not want to commit to either a positive or negative position

toward CCS technology. Stakeholder questions were related to the technical process of capture, transport and storage of CO₂, the risks and environmental impacts of CCS, how the project would be funded and why this particular region was being considered. Concerns were related to the risk of CO₂ leakage, such as possible contamination of the ground water reservoir of one of the towns that is located on top of one of the prospective storage sites. CO₂ was described as toxic, dangerous, poisonous, polluting and pathogenic, implying a need for basic information on CO₂ and CCS.

Similar to the representative local public sample, stakeholders at the Scottish site were more knowledgeable about CCS than stakeholders at the Polish site. They expected to be involved/consulted in case of a real CCS project. The key priorities for stakeholders were

related to local economic issues such as creation of jobs and effect on existing enterprises. From this point of view, CCS was considered as positive and thus welcomed by most stakeholders. It has to be noted that the area was already used to offshore operations. As the offshore environment was seen as a resource for fish, oil, gas, offshore renewable energy (such as large-scale wind projects), to some stakeholders it would only make sense to also look into CCS as an option. Objections to infrastructural development thus seem unlikely, provided it would fit comfortably with other ongoing developments in the region. Scottish stakeholders had all heard of CCS and knew that it deals about storing carbon dioxide in geological formations. They asked a large number of detailed questions, *e.g.* where the CO₂ pipelines would be located and what above sea-surface infrastructure would be required, if any. Some doubts were however mentioned concerning whether CCS would bring many new jobs to the area, but CCS was still broadly considered as an opportunity to revitalise local ports and the oil and gas sectors (*e.g.* by utilising some of the same offshore infrastructure). According to the stakeholders, environmental issues needed to be assessed but were unlikely to be a ‘show-stopper’. Points of concern are issues related to integration with other operations, impacts on fishing industry, and possible objections from environmental protection organisations.

In all, survey, media and desk research results seem to be in line with, and complementary to, the results of the stakeholder interviews. These results were then used to prepare for the second step of the research which is described in Section 2.

2 STEP 2: FOCUS CONFERENCES

2.1 Method

The objective of the second step was to apply and evaluate a newly developed participation method called the ‘focus conference’, which combines some effective elements from the already existing repertoire of other public participation methods [20–24] such as focus groups [25, 26], the large group process [27], deliberative polling [28], consensus conferences [29], citizen panels [30], and citizen’s juries [31]. This participation tool was developed by the Independent Institute for Environmental Issues (UfU) and it was the first time that the focus conference method was applied and evaluated in this particular form.

The aim of the focus conferences was to present and test a format in which project operators, authorities, and the local public could enhance their cooperation in

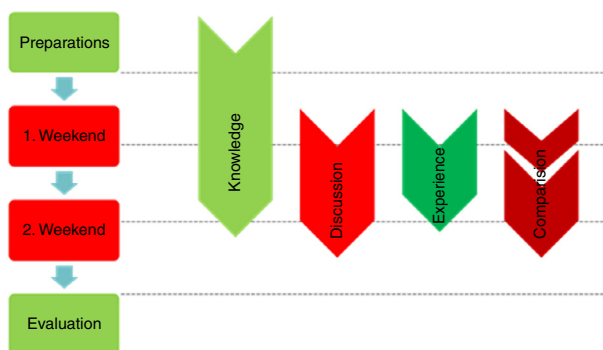


Figure 4

Phases and elements of the focus conference.

project planning. As such, focus conferences aimed to serve as a “hinge” between social site characterisation as a research effort and as applied to real-life project settings. Therefore, the aim was to have prospective site operators and authorities take part in the discussion. At the Polish site, the operator was the project partner, PGNiG, who presented the industry perspective at the Polish Focus Conference. The presence of the project developer, as well as the site being onshore and easy to locate, made it possible in Poland to have a realistic discussion about possible local development of CCS. In Scotland, the operator was unknown (no concrete project plans) and the site is offshore. However, *Shell* retains an interest in developing the offshore storage site, hence a representative from this company presented the general industry view on CCS while a representative from the Scottish Government explained the national policy view on CCS, in addition to technical explanations by two independent academic experts.

The focus conference method structures the participation process into two weekends with at most one month between the weekends. In the setup of the focus conference, particular emphasis was given to providing knowledge, allowing space for open discussions, allowing each participant to gain their own experiences and creating opportunities to compare their own opinion with the opinion of others during as well as between the weekends (*Fig. 4*).

The focus conferences on CCS for the SiteChar project took place on two weekends in March and April 2012. A group of 14 (Scotland) and 16 (Poland) participants recruited from the local public gathered to be informed about CCS technology, to discuss their perceptions of the rewards and risks of CCS technology, and to state their preferences for acceptable implementation of

CCS projects. The same group participated in both weekends (although three participants in Scotland did not return for the second weekend, in one case for personal reasons and in the other two cases due to lack of confidence in following the technical detail). Respondents were recruited by a market research firm taking into account several socio-demographic criteria (age, gender, social and labour market position). Participants received financial compensation for travel, were provided with food and lodging and received an allowance.

During the weekends, the participants had the opportunity to learn about the scientific, technical and social aspects of CCS technology and to learn about different points of view on CCS technology. Time was taken to create trust in the objectivity of the organizers, to create a safe environment in which participants did not feel inhibited to express themselves, and to select the speakers and discussion materials, ensuring that all key perspectives on CCS were represented and the discussion would be balanced. To this end, experts from research, politics, industry and Non-Governmental Organisations (NGO) were invited to participate in both weekends, during which they gave presentations and answered questions from the participants. However, despite great efforts, eventually an NGO was found willing to join only for the Polish focus conference. NGO approached in Scotland acknowledged the value of the process, but were unable to attend due to staffing limitations. The focus conference process resulted in a positioning paper written by the participants representing a statement on CCS technology from their perspective, which they wrote during the last weekend of the conference.

2.2 Results and Implications

Here we summarize the key messages from the focus conference participants. However, interested readers are strongly encouraged to read the citizens' own (more elaborate) wording of the issues [16].

In Scotland, the participants' most important condition for acceptable deployment of CCS is that if CCS is at all worth pursuing, it should only be developed as part of a suite of options to combat climate change. More specifically, most of them think that CCS should be developed on a parallel track with renewable energies. In Poland, the majority of the participants agree that there are too many open questions regarding risks, benefits to the region, costs, and the equivocal position of the government. In all, the Polish participants think that at present CCS is generally too costly to invest in and that there are too many uncertainties locally to justify a project that lacks a clear local benefit. On balance, of the Scottish participants, 5 want CCS along with other

measures; 3 are undecided as to whether they want CCS; 2 do not want CCS but prefer other measures; 1 abstained from voting. Of the Polish participants, 11 think that there are too many uncertainties at present to opt for CCS. The other 5 participants are against the application of CCS in the gas fields in their area. Key messages from both groups are summarized below. The key messages support earlier findings on CCS perceptions (for an overview of relevant findings, [32]).

- *Agreeing that climate change happens and that measures should be taken does not imply agreement on CCS as a suitable method to curb climate change.*

Both groups mentioned that if CCS is to be effective against climate change, it is not enough to introduce this technology only in Scotland or in Poland. Its application should be worldwide;

- *Acceptability of CCS is related to other measures to combat climate change.*

A majority of both groups agreed that they would prefer other measures to combat climate change than CCS. Furthermore, albeit more explicitly in Scotland than in the Polish group, both agreed that if CCS was to be applied it should be a short-term solution implemented along with an exit strategy so as to not divert attention from other options which are perceived to be more sustainable in the long-term such as renewable energy;

- *Pay attention to national and local advantages and disadvantages.*

On a national level, there might be benefits such as the further use of coal, which is the main argument in Poland, or a leading role taken by Poland in developing the technology, which was raised as an opportunity also in Scotland. The Polish participants mentioned that the introduction of the technology could lead to an increased influence by Poland on the European policy for climate protection. However, they also mentioned international downsides such as becoming a 'garbage dump' for European CO₂ emissions. For the Polish group, therefore, one of the conditions for accepting a local CCS project was to store only the CO₂ produced within the region. In contrast, Scottish participants discussed a possible role for Scotland as a main store of imported CO₂. Nationally as well as locally, employment gains are an issue. Attention should also be paid to possible local disadvantages. In Poland, the location of the storage site raises concerns about possible loss of value of surrounding real estate;

- *Pay attention to risks and uncertainties.*

Regarding the acceptability of risk, both groups discussed the 'unknowns' of CCS and the reliability of information on risks. Among the Polish group, the acceptability of risks gained weight in the discussion when it became clear that a CCS project would have

little, if any, direct benefits to the region. Along with the costs of CCS, the presence of too many uncertainties was the main reason for the Polish participants not to opt for CCS;

- *National and European governments should clarify their role/position.*

The participants argued that the role of national governments and the European institutions should be to develop a vision and to stimulate public involvement in decision-making regarding solutions to climate change. The Scottish participants stated that if CCS is to be developed further, they would like to see a variety of regulations or conditions controlling the development. The government is not entirely trusted on viewing CCS as part of a long-term strategy for curbing climate change instead of being just a “quick fix” to get them out of the problem of needing deep carbon cuts to meet their legally-bound targets. Regarding the regulation of safety, both groups request clarification of the responsibility for the project. The Polish participants mentioned that the government should financially support the development of CCS and more generally provide clear legislation on CCS;

- *Citizens expect public communication and participation activities.*

Both groups agreed that for effective public engagement, information campaigns on CCS are needed. Moreover, both groups mentioned that the public should not only be informed about CCS, but also about alternative solutions to reduce CO₂ emissions into the atmosphere such as renewable energy and lifestyle and behavioral changes. The Polish participants proposed a referendum to let citizens decide whether they want a project in the area or not. The Scottish participants recommended public engagement to be built-in to project development from the start, not just for CCS but also for other low carbon technologies.

3 STEP 3: PUBLIC OUTREACH ACTIVITIES

3.1 Method

As a third step of the research, generic and site-specific information regarding the site explorations within SiteChar was made available to the general public as well as to the local public at the Scottish site and at the Polish site. To this end, separate sections were added to the project website offering information in both English and Polish. The style and complexity of this information was tailored to:

- low awareness and knowledge levels of a general lay audience;

- general good practices of information provision such as objectivity, balance, and validity [32-34];
- specific information needs as derived from the social site characterisation and other research [35, 36].

The aim of making this information available was to support other public awareness activities: the focus conferences and the information meetings. For example, the web pages were used to announce the focus conferences, to make information available between the two weekends, and to offer a place where the positioning papers could be published after the focus conferences.

Information meetings were held at both the Polish site and at the Scottish site, one month in Poland and three months in Scotland after the focus conferences and shortly before the second survey (*Sect. 4*). In publicity efforts these meetings were announced as ‘climate change debates’. At the information meetings, participants in the focus conferences were given the opportunity to present their positioning paper.

3.2 Results and Implications

The information meeting at the Polish site took place on the 25th of June 2012 in Góra and was open to everybody for participation. The aim of the information meeting was to inform the local public about CCS technology, the possibility of CO₂ storage in the region and to present the positioning paper and its importance for the Polish climate strategy. About 40 citizens, guests and experts participated in the information meeting, which the focus conference participants themselves helped to organise. Ten experts from politics, industry, eNGO and research who are engaged in the topic of CCS technology in Poland were invited to the meeting. Three of them accepted the invitation and two of them agreed to prepare short presentations explaining the CCS technology (Czesław Rybicki, AGH University of Science and Technology) and its development in Poland (Adam Wójcicki, Polish Geological Institute).

After a short introduction by the organizers to the SiteChar project and the two expert presentations, three participants in the focus conference presented the positioning paper. In the next part of the meeting the invited stakeholders from politics, research and industry were invited to share their view on the participants’ positioning paper and CCS technology in general. Elżbieta Wróblewska from the Ministry of Economy, who represented the Polish government, emphasized that Poland will need to adopt CCS technology to fulfill EU agreements on reducing CO₂ emissions. She admitted that CCS is a new and expensive technology but that Poland should invest in its development.

In the opinion of the local policy makers CCS technology is still an “unknown field” and they do not feel they can give a clear statement in favour or against the technology. Tadeusz Pawłowski, Mayor of Rawicz, mentioned that the water reservoirs for Rawicz are located on top of the Załęcze gas field, and that a CO₂ leak could therefore have catastrophic consequences for the region. The local decision makers did not believe the government’s promise that the communities will get a substantial direct benefit from the CCS projects. They have heard such claims too often before and then nothing happened. In their opinion it is too early to discuss a CCS project in the area.

The organisers and participants also discussed how to involve local citizens in decision making processes and what can be done to encourage citizens to participate in, for example, information meetings. The majority of participants stated that the local citizens are not very active, because there is no tradition of public participation in decision making processes. To gain residents’ attention on some topic probably something bad must happen first, for example ‘when they will have sparkling water coming out of the tap’.

The Scottish public information meeting was held in Elgin, Moray in September 2012. This meeting was held later than the Polish information meeting due to local government elections in the area earlier in the year that could impact upon the interest in and results of such a meeting. Its aim was similar to that of the Polish information meeting, including the presentation of the positioning paper. Unfortunately, despite several invitations and reminders, none of the Focus Conference participants were able to attend the meeting – although some of them did send their apologies. Therefore, Dr. Leslie Mabon from the University of Edinburgh agreed to present the outcomes of the positioning paper at the information meeting. Two local councillors also agreed to give short presentations – Councillor Fiona Murdoch formally welcomed the guests and added some local context. Then Rhys Howell (UEDIN) explained the process of CCS and its underpinning rationale in terms of climate change mitigation. Next, Councillor Graham Leadbitter explained how he saw CCS fitting into a broader context of climate change and environmental issues. Finally, Dr. Leslie Mabon presented the positioning paper. A dozen local citizens in total attended the meeting. None of these people had had any previous involvement in the SiteChar project and all had heard about the meeting from the newspaper advertisements or email invitations.

There was a more formal question and answer session following the presentations, and plenty of time for informal discussion over food and drink. It transpired that a number of citizens was frustrated with the development

of energy technologies, particularly wind and biomass, in the region and felt that developers were forcing these projects upon them. Others were open to the idea of further developments in the region, including CCS, if it could be shown that developing these technologies was in the region’s interest – particularly in terms of economic benefits. Pragmatically, there was a feeling that whichever technology could provide the most cost effective low carbon energy should be pursued.

The issue of public participation in decision making came up, particularly in the informal discussions. Some participants were keen to ask the organisers for advice on how they could respond to or challenge planning decisions made in their community, explaining they felt the process was too complicated and unclear for ordinary members of the public to engage in. Others expressed slight concern that – on the basis of what they had heard in the media – CCS in the North Sea was a ‘done deal’ and that public consultation at this stage would not do much to change it. Questions were asked about who would have long-term liability for a CO₂ storage site, and about how much it would cost to build, operate and insure a CCS project. There was also a vocal minority of climate change sceptics who did not believe that any climate mitigation activities were justified, and thus that CCS served no purpose. The more sceptical members of the audience were very keen to point out perceived weaknesses in the climate science and political processes underpinning ambitions for decarbonisation of energy supply, and came well prepared with large volumes of material to support their arguments.

In all, the results discussed up to now demonstrate the usefulness of Steps 1-3 not only to get acquainted with the area, but also to make oneself known to and trusted by the local community. They also demonstrated that in public awareness and engagement work, there is no clear divide between research and practice. In practice, however, prospective site operators may have more difficulty earning trust from local stakeholders discussing a real project than social researchers discussing a possible, hypothetical project. Nevertheless, the mere fact that the engagement processes were held led to some participants assuming that a real project must be in the offing. The principles of open interviewing, surveying and involving local residents would be equally helpful in both situations to identify questions, concerns, and obtain cooperation in local outreach activities. As mentioned in the previous chapter, the organizers of the Scottish focus conference did not succeed in involving an NGO, however results of the Scottish focus conference show that the absence of an NGO is not necessarily a ‘show-stopper’ for a balanced dialogue.

4 STEP 4: FINAL SURVEY

4.1 Method

The fourth and final step of the research consisted of a second survey that was again held at both sites. The survey, consisting of telephone interviews, was conducted in both Poland (N = 1 006) and Scotland (N = 864) by market research firms among new representative samples of the local population (*i.e.*, other respondents than in the first survey). In Poland, it was held in July and in Scotland it was held in September 2012. The market research firms were selected because of their research experience and familiarity with the area. A quota sample was used to guarantee representativeness on age, sex, and education/employment. The interviewer introduced the research as a 15 minute interview about ‘life in your local area’. Respondents willing to participate subsequently received some screening questions (postal code, age, gender, employment) to determine whether they fitted the profile. If so, the interviewer continued with the first question. If not, they were thanked and the interview was ended.

As one of the aims of the second survey was to measure changes in awareness and opinions over time, the survey largely contained the same questions regarding CCS as the first survey. There were two important differences however. Firstly, the first survey took the shape of a local area satisfaction survey. To this end, apart from questions on CCS, the questionnaire also contained questions regarding other issues relevant for the local area. In contrast, the second survey focused solely on CCS as a local issue. In contrast to the first survey, the second survey contained several statements on CCS in general and respondents were asked to state to what extent they either agreed or disagreed with these statements. Some of these statements were based on opinions voiced in the focus conferences. Others were based on issues that have shown to be important explaining factors of CCS acceptability among general publics in previous research [37]. To keep the Scottish and Polish version of the survey the same, they were limited to aspects of CCS that were relevant for both sites, either onshore or offshore.

Including these statements in the survey ties it to the focus conference results since the survey data enhance the validity as well as the generalizability of the focus conference data. The focus conferences had only a small number of participants (14 in Scotland and 16 in Poland). Such qualitative research efforts provide unique in-depth and detailed insights in the public’s thoughts and opinions about CCS, but it remains unclear to what extent opinions voiced in such small

groups are representative of what the local community as a whole thinks about CCS. Replies to the statements, collected from a representative community sample, can be used to validate statements of the focus conference respondents and investigate to what extent opinions are shared within the local community.

4.2 Results and implications

Since two surveys at two sites result in a wealth of data, only the clearest between-survey and between-country differences are listed here. For a full overview the reader is referred to the reports of step 1 [15] and step 4 [18]:

- *Level of awareness and knowledge of CO₂ and CCS.* Compared to the first survey, awareness and knowledge of both general and local plans for CCS were still low, particularly in Poland (*Tab. 2, 3*). However, in Poland a slight increase in awareness was found, which may be ascribed to the public participation efforts mentioned in Sections 2 and 3. Furthermore, Polish respondents who had at least heard of CCS more often correctly stated the aim of CCS than in the first survey when asked to specify what they had heard (‘will stop CO₂ from entering the atmosphere’ or ‘will help stop climate change’). No such effects were detected for the Scottish site for which there are at least two explanations. Firstly, because awareness and knowledge levels are already higher in Scotland, the survey instrument may have been too insensitive to detect further improvements. Secondly, during the SiteChar project, the Moray and adjacent Aberdeenshire area faced other CCS-related developments and also ongoing debates over wind farm applications that have likely ‘interfered’ with the public participation efforts within SiteChar;
- *Expectations of local CCS plans.* Most respondents expected CCS to have a positive impact on the area. Similar to what has been found in the first survey, in Scotland these positive expectations were mainly related to perceived economic advantages, while in Poland these positive expectations were mainly related to perceived environmental advantages (*Tab. 2, 3*). This is in line with the findings from the media analysis (*Sect. 1*) that the Polish debate accentuates environmental effects, whereas the Scottish debate accentuates economic effects. Since the number of respondents reporting negative impacts was rather small in both countries, results are not reported here as they add little validity to the focus conference results. Interestingly, the number of Polish respondents who reported not to know whether CCS would have a positive or negative impact on the area

TABLE 3

Most frequent (top 5) answers to open-ended questions regarding awareness of local CCS, expected positive and negative impact (%)

Poland		Scotland	
1 st survey	2 nd survey	1 st survey	2 nd survey
What have you heard about plans for CCS in your local area?			
N = 145	N = 208	N = 145	N = 208
25.3 just that it's going to happen	22.6 just that it's going to happen	26.5 just that they are looking into it	25 just that they are looking into it
7.7 relevant to waste dump	9.1 it will stop CO ₂ going into the atmosphere	23.4 just that it's going to happen	21.1 just that it's going to happen
6.5 it will stop CO ₂ going into the atmosphere	7.7 help to stop climate change/global warming	8.8 used old oil fields	11.3 Peterhead power station/St. Fergus gas terminal is part of the development
4.2 they will install filters on the stacks	7.2 just that they are looking into it	8.2 wind farms/turbines	9.4 used old oil fields
4.1 just that they are looking into it	4.8 stop pollution	6.1 it will stop CO ₂ going into the atmosphere	5.9 nothing specific- just heard the name
Why you think CCS would have a positive impact?			
N = 89	N = 116	N = 237	N = 225
53.2 better for the environment	54.3 better for the environment	68.5 it will bring jobs	74.2 it will bring jobs
17.9 reduce toxic waste	25 it will bring jobs	25.5 better for the environment	22.3 improve the local economy
9 help to stop climate change/global warming	24.1 reduce smog	21.3 improve the local economy	16.2 better for the environment
7.9 reduce smog	17.2 help to stop climate change/global warming	10.8 help to stop climate change/global warming	9 help to stop climate change/global warming
7.5 create green energy	13.8 improve the local economy	6.2 create green energy	5.9 rise profile of the area
Why you think CCS would have a negative impact?			
N = 29	N = 37	N = 50	N = 52
69.4 bad for environment	37.8 bad for environment	29.7 bad for marine life	29.5 bad for marine life
11 CO ₂ will escape to the surface (and suffocate people)	13.5 CO ₂ will escape to the surface (and suffocate people)	15 bad for fishing	11.8 negative visual impact
8.7 CO ₂ will escape to the ground water	10.8 unproven technology	13.9 negative visual impact	10.6 it would be viewed suspiciously
7 risk of leaks	8.1 not a real solution to the climate problem	9.1 no specific reason - just don't agree with it	10.5 no specific reason - just don't agree with it
6.6 negative visual impact	8.7 CO ₂ will escape to the ground water	8.5 not a real solution to the climate change	10 bad for fishing

Note: The number of respondents differs across questions because questions were only provided to respondents based on earlier answers in the survey (e.g. only when indicated to have heard of local CCS plans, or only when indicated to expect positive or negative impacts).

significantly increased. Again, this may be an effect of information provision: providing information to audiences with low knowledge levels may well raise more questions initially than it answers. In Scotland,

the number of respondents who expected 'no impact at all' increased significantly;
 – *Perceptions of CCS technology*. Many more Polish than Scottish respondents perceived risks of leakage

of CO₂ (Tab. 3). Nevertheless, in both samples the perceptions of CCS were rather positive. Most respondents reported to have trust in proper regulation and monitoring of CCS. Most also expected that CCS could help their country meet international targets for CO₂ reduction and buy time to develop renewable energy sources. Additionally, Scottish respondents believed that CCS might give Scotland a technological advantage over other countries. The Polish respondents were not so sure about this. Many respondents in both countries were uncertain about the costs of using CCS and whether the technique is ready for widespread use. Many respondents answered ‘don’t know’ to this question. Particularly in Poland, CCS was perceived as essential for tackling climate change;

- *General sense of urgency of reducing CO₂ emissions.* In both samples, the majority of respondents agreed that ‘something must be done’ about climate change;
- *Support of local CCS plans.* Overall, the respondents tended to support the use of CCS both locally and nationally. Among those who were unsupportive or undecided, some highlighted the desire for more information, public consultation and – especially in Poland – guarantees for safety as factors that might make them more supportive. This should be taken into account in future public outreach concerning actual project plans.

In all, differences in knowledge levels about the consequences of CCS (much lower in Poland) and proximity of the site to the local community (much closer in Poland) appear key explanations for differences found in perceptions and expectations of the benefits or risks associated with CCS. This combination of factors is a likely cause of the differences observed in the perceptions and appreciation of the risks of CCS, which weighed heavier in the Polish discussions, *versus* the (economic) benefits of CCS, which weighed heavier in the Scottish discussions. Whereas systematic research into the effects of proximity of potential storage site to the respondents has up to now been scant, previous research has shown correlations between knowledge and perceptions of CCS [35].

CONCLUSION

Social site characterisation and public participation activities were conducted at two prospective CCS sites in Poland and Scotland. Social site characterisation and focus conferences can provide insight into the way local CCS plans will be perceived by the local stakeholders, which can be quite different across countries and within countries across different sites. Using a combination of qualitative and quantitative methods, this

research has resulted in first-hand accounts from Polish and Scottish citizens themselves on:

- the level of awareness and knowledge of CO₂ and CCS;
- questions and concerns about CCS (in the context of other climate mitigation methods);
- expectations of CCS on local and (inter)national level;
- the most effective (preferred and trusted) communication channels;
- the most important and trusted organizations and stakeholders;
- relevant developments in the area that may affect the opinion of local CCS plans;
- conditions for implementation of CCS on (inter)national as well as local scale.

Several similarities and differences between the two sites can be distinguished. The social context of the sites was rather similar; both area’s struggle with unemployment and have an interest in further developing the area in terms of attractiveness for tourism and nature. However, where the Scottish site already has well-developed offshore operations, such infrastructure is not present at the Polish site. Proximity to the sites also differed: while the Scottish site is offshore, the Polish site is onshore and thus closer to the living area of the citizens. With regard to awareness there is a large difference between the two sites, at the Scottish site 53% had never heard of CCS, while the unawareness was much higher (78%) at the Polish site. Possibly also due to the low awareness of CCS, at the Polish site more misperceptions exist (*e.g.* that CCS will reduce smog). Expectations of what CCS might bring to the region was also different; while at the Scottish site expectations are more economically of nature (it will bring jobs to the area), expectations at the Polish site are more environmental of nature (what are the risks of leakage?; is it good or bad for the environment?). These differences combined could explain that at the Polish site, acceptance of the technology is lower than at the Scottish site; not only the proximity to the site, but also the expectancy of what the technology can provide the area, given existing infrastructure and experiences (high at the Scottish site, low at the Polish site).

In this research, two innovative techniques for obtaining public responses to project plans for CCS technology were applied. First, the surveying technique presented here shows that public awareness and perceptions of local plans for CCS can be measured reliably without alarming/frightening people upfront that something in their area may happen, and without encouraging them to develop opinions that have no base in awareness or knowledge of any plans. Second, the focus conference method may be suitable for raising public awareness and to assist public opinion formation about complex issues such as CCS.

Moreover, the method can be used to initiate local discussion and planning processes together with the local community in a balanced, informed way. Both techniques are complementary. Whereas surveys offer the opportunity to obtain results that can be generalized to the community as well as helping to create a baseline to measure shifts in local situations, focus conferences provide a rich, in-depth picture of the process of awareness raising and opinion formation within the community. In general, the use of a combination of qualitative and quantitative social research techniques requires a great amount of effort, time, and expertise. At the same time, the use of a set of complementary methods for obtaining a 'social map' of the area produces the most reliable, consistent, and detailed lessons regarding effective public engagement strategies for developers, regulators and governments. Together they provide a full description of the area and minimize the chance that important issues are overlooked. The use of multiple methods enables verification of results against each other, which makes findings more robust and thus a more reliable base for developing public participation strategies such as the information meetings.

Some questions remain regarding the duration of these effects and their applicability to a real project setting. One of the main critiques on 'public engagement' in the literature is that it is often a one-off intervention that satisfies funders and researchers, but does not provide long-term institutional capacity building of engagement or acceptance by policy makers [38-40]. Public engagement efforts are only effective if they make citizens feel listened to, involved, and empowered. In a real project setting, this can only be achieved if the citizens' suggestions are taken seriously and are truly taken into account in decision making regarding the project as well as in general policy making (even if not necessarily actually implemented). To achieve this, key to a constructive focus conference is trust in the independence of the facilitators. In a real-life project, hiring independent facilitators would be recommended. Other key recommendations when using focus conferences or similar methods as public engagement tools are:

- ensure trust in the facilitators and allow time to create a safe environment;
- embed focus conferences in a range of public engagement activities;
- do not extrapolate findings from small group research to communities (use surveys for that);
- balance positions taken by speakers and in discussion materials.

Regarding the duration of effects of the focus conference on public attitudes and empowerment, the participants indicated they wished to stay involved. However, in Scotland this commitment did not last long enough to motivate any of the focus conference participants to

present the Scottish positioning paper at the information meetings. To assess why, in-depth post-hoc interviews with some of the focus conference participants and deeper analysis of the recorded focus conference discussions were conducted as part of the European project ECO2⁽³⁾, to see what they thought of the event in retrospect. One of the key themes emerging from these interviews was that CCS was only one small part of a range of environmental issues affecting the Moray area at the time [41], and also the sense among some participants that further participation would have little effect on the trajectory of CCS deployment in Scotland [42].

The second survey offered the opportunity to validate and quantify findings from the focus conferences, but it has only been partially successful in detecting effects of the focus conferences and information meetings. At the Polish site a slight increase in awareness was found which may be ascribed to the public participation efforts. At the Scottish site, too many other CCS-related activities have probably been developed throughout the course of the SiteChar project to enable detection of the effects of the focus conferences and information meeting in the second survey (in particular cancellation of a much publicised CCS project during the project). Furthermore, the information meeting was not as well-visited as at the Polish site. Finally, since knowledge levels were already higher in Scotland than in Poland, additional improvements may have gone undetected in the survey.

The study presented in this article is of a hybrid nature. On the one hand it could be seen as a field experiment, in which several methods are used to measure developments in public opinion and to create a 'safe space' for opinion exchange between stakeholders. On the other hand, these methods have been applied with 'real' people and created 'real' local dialogue. As such this study resembles the EU FP7 project IPPA⁽⁴⁾ in which the Swedish RISCUM model and other approaches to public involvement were implemented in five radioactive waste management programmes in Central and Eastern European countries, aiming to establish arenas where different stakeholders can move forward together to increase their understanding of the issues involved in radioactive waste disposal and of their respective views. A discussion of the findings [43] raised the following issues. Firstly, what defines 'successful implementation'. From a research point of view, this would be the extent to which participation methods succeed in creating a "safe space" for opinion exchange through trust, fairness, etc. The practical point of view is usually more output-oriented and questions the

³ <http://www.eco2-project.eu/>

⁴ <http://www.ippaproject.eu>

extent to which participation methods lead to project acceptance. Secondly, and related, how it would be possible to introduce an equalizing participation method under circumstances of unequal power – as is often the case in real project settings. Particularly in non-Western European countries, such methods may create false hope for democratic participation. As Arnstein's Ladder of Citizen Participation [44] demonstrates, many forms of public participation are actually degrees of 'tokenism' rather than real attempts at building partnerships. Tokenism usually backfires when recognized while real power to influence decision-making makes stakeholders generally more collaborative, but either way the risk of project delay and cancellation can never be eliminated. This study thus not only underlines the need of integrating the management of the social issues in the life cycle of CCS projects, it also underlines the need to discuss the aim of stakeholder participation, its desired or possible outcomes and the labelling of these outcomes as either effective or ineffective.

In conclusion, the techniques for social site characterisation and public participation presented in this paper are suitable for raising public awareness about complex issues such as CCS and to initiate local discussion and planning processes with the appropriate type of information, through appropriate media, and involving all relevant stakeholders. The results can be used to start the process of information provision (for example by drafting a FAQ page and managing expectations) and public engagement (for example involving stakeholders and selecting a proper location and format). Regarding the content of communication, the findings underline the importance of transparency in information provision, the need to discuss CCS in the context of climate change and all mitigation options, the need for expectations management (for example regarding extra employment), information needed to fill knowledge gaps, and the need for an open dialogue about the risks of CCS, particularly CO₂ leakage. Regarding the process of project development, these findings show which stakeholders to involve and which communication channels to use. However, the 'proof of the pudding is in the eating'. For a long-term effect in a real life project setting, it will be vital that these efforts, as well as their outcomes, are embedded in real projects and are related to national and local policy agendas and priorities.

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